Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES
33972 TEXAS STREET SW
ALBANY, OR 97321
T. 541.791.1667 F. 541.791.1699
www.parametrix.com

M E M O R A N D U M

Date: **August 18, 2006**

To: **Burt Shephard, EPA Region 10**
Jeremy Buck, USFWS

From: **Bob Gensemer**

Subject: **A few additional questions/points of clarification for Portland Harbor TRVs**

cc: **Chip Humphrey, EPA Region 10**
Eric Blischke, EPA Region 10
Joe Goulet, EPA Region 10
Jennifer Peterson, OR DEQ
David DeForest, Parametrix
Brad Hermanson, Parametrix

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During our recent review of aquatic and wildlife TRVs for chemicals of primary interest (dioxin, PCBs, DDT, PAHs), additional questions and information were brought to our attention by Burt Shephard and Jeremy Buck. Some of these were based on the need for doing additional analysis, as indicated in EPA's July 6, 2006, letter to the LWG regarding TRVs. These remaining issues are identified and discussed below, along with recommendations for resolution. For some, it may make more sense to propose changes prior to completion of the Round 2 Comprehensive Report, while it may be necessary/desireable for others to be addressed until the baseline risk assessment.

1. **Aquatic Tissue Residue TRVs:** Burt Shephard recently provided a spreadsheet to Parametrix with an up to date summary of the residue-effects literature for cadmium, DDD, DDE, DDT, 2,3,7,8-TCDD, and total PCBs. This spreadsheet was part of a database that eventually was incorporated into the U.S. Army Corp of Engineers Environmental Residue-Effects Database (ERED). As summarized for several chemicals below, we evaluated this spreadsheet to determine whether any changes to the PRE TRVs are warranted.

   Cadmium: The whole body tissue residue TRV for cadmium used in the PRE was 0.09 mg/kg wet wt. As noted in the PRE this value was based on the 5th percentile of literature LOECs provided in Appendix B of the PRE and the TRV of 0.09 mg/kg wet wt. is equal to the lowest LOEC identified in Appendix B. It is unclear how LWG's 5th percentile was determined, but it is reasonable that the 5th percentile is near the lowest LOEC given that 18 LOECs are available (i.e., 1/(18+1) = 0.052 or 5.2%). The PRE TRV of 0.09 mg/kg wet wt. is lower than the 5th percentile literature toxic tissue screening concentration (TSC) of 0.15 mg/kg wet wt. reported in Dyer et al. (2000). The spreadsheet provided by Burt Shephard included an effect concentration of 0.005 mg/kg wet wt. based on reduced growth in Atlantic salmon (*Salmo salar*) and cited Rombough and Garside (1982). In Appendix B of the PRE, the LWG cites Rombough and Garside (1982) as the source for a LOEC of 0.09 mg/kg wet wt. and comments that the cadmium concentration in control fish was 0.05 mg/kg wet wt. Thus, Burt Shephard's spreadsheet is in disagreement with the LWG's interpretation of this study. If Burt's spreadsheet is correct, this could influence the PRE TRV for cadmium. However, assuming the LWG's interpretation is correct (0.005 mg/kg wet wt. is probably within typical background concentrations in fish), the PRE LOEC of 0.09 mg/kg wet wt. is more conservative than the Dyer et al. (2000) 5th percentile and therefore probably adequately conservative for the PRE.

Conclusion: No change in the cadmium tissue residue TRV is suggested unless we are misinterpreting Burt's spreadsheet.

2. DDE: The whole body tissue residue TRV for DDE used in the PRE was 1,000 µg/kg wet wt., which was the 5th percentile literature TSC reported in Dyer et al. (2000). There are several studies in Burt's spreadsheet with effect levels lower than the Dyer et al. (2000) 5th percentile literature TSC, including reduced growth in rainbow trout at a concentration of 120 µg/kg wet wt. and increased mortality in striped bass at a concentration of 145 µg/kg wet wt. A more conservative screening concentration could thus be warranted based on these data.

   Conclusion: The studies in Burt's spreadsheet with lower effect concentrations should be reviewed, incorporated into the LWG's dataset if appropriate, and a new 5th percentile tissue residue LOEC could be calculated if desired.

3. DDT: The whole body tissue residue TRV for 4,4'-DDT used in the PRE was 470 µg/kg wet wt., which was the 5th percentile literature TSC reported in Dyer et al. (2000) and the TRV for total DDTs was 290 µg/kg wet wt. based on the 5th percentile of literature LOECs provided in Appendix B of the PRE. Burt's spreadsheet includes an effect concentration of 300 µg/kg wet wt. for 4,4'-DDT in brook trout that experienced mortality, convulsions, and distention of mouth and opercles. However, the next highest 4,4'-DDT effect concentration was 900 µg/kg wet wt. so the PRE TRVs are perhaps adequately conservative when all toxicity values are considered.

   Conclusion: No change in DDT tissue residue is suggested, but are we sure there are no additional *total* DDT toxicity data available that would warrant changes to the 5th percentile value that LWG calculated?

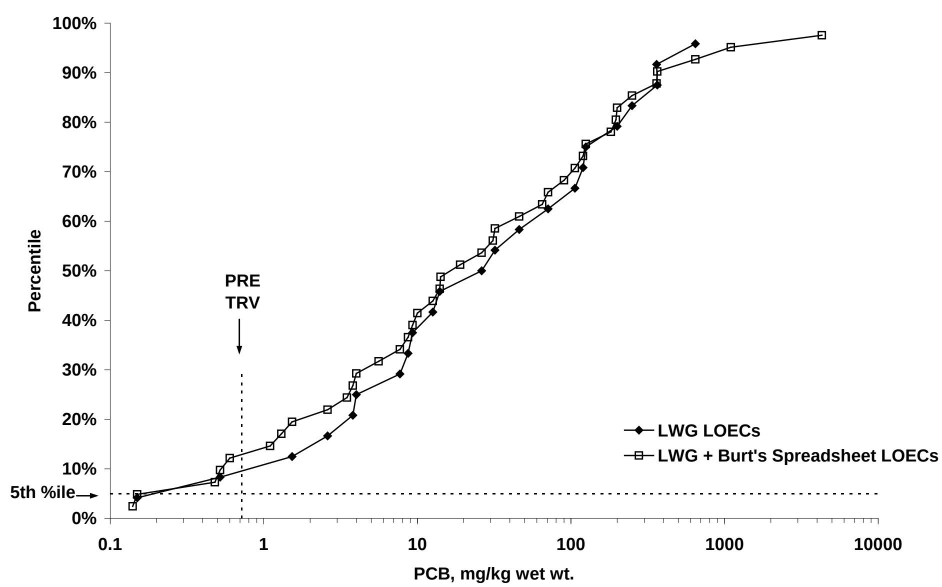
4. 2,3,7,8-TCDD: The whole body tissue residue TRV for 2,3,7,8-TCDD used in the PRE was 90 pg/g wet wt., which was based on the 5th percentile of literature LOECs provided in Appendix B of the PRE. There are no effect concentrations in Burt's spreadsheet that are well below the PRE TRV of 90 pg/g wet wt. Burt's spreadsheet included an embryo LOAEL of 40 pg/g wet wt. for hemorrhage and tissue deformities in fathead minnows and TCDD concentrations of 44-47 pg/g wet wt. were associated with mortality in sac fry. Overall, however, these effect levels are within a factor of approximately two of the PRE TRV and given that 5th percentile values were considered acceptable for developing PRE TRVs, there will be effect concentrations lower than the TRV when sufficient data points are available.

Conclusion: No change in 2,3,7,8-TCDD tissue residue may be necessary because the new, lower, values would not likely affect the final 5th percentile TRV to a significant degree.

5. Total PCBs: The whole body tissue residue TRV for total PCBs used in the PRE was 720 µg/kg wet wt., based on the 5th percentile of literature LOECs provided in Appendix B of the PRE. Burt's spreadsheet does include some effect concentrations lower than the PRE TRV, including an effect concentration of 72 µg/kg wet wt. associated with increased mortality, reduced growth, jaw deformities, and fin erosion in Japanese medaka, elevated embryo mortality in white sturgeon at 140 µg/kg wet wt., reduced ability of coho salmon smolts to adapt to seawater at 150 µg/kg wet wt., and increased mortality and reduced growth in fathead minnow at 480 µg/kg. However, the LWG disagreed with at least some of these values. For example, the LWG did not use the Japanese medaka LOEC of 72 µg/kg wet wt. because effects were observed over four weeks of exposure, but whole body concentrations were only measured after 96 hours. Figure 1 shows the LOECs from Table 1-1 in Attachment 1 to Appendix B of the PRE, as well as the Appendix B LOECs combined with those from Burt's spreadsheet. The figure suggests that a lower TRV may be appropriate for the PRE, such as approximately 150 µg/kg wet wt. (note that a more thorough analysis would be needed if there was interest in revising the total PCB TRV – Figure 1 was compiled based on the LWG's values and limited details were provided in Burt's spreadsheet). For comparison, the Dyer et al. (2000) 5th percentile literature TSC was 800 µg/kg wet wt. (higher than the PRE TRV of 720 µg/kg wet wt.).

Conclusion: The studies in Burt's spreadsheet with lower effect concentrations should be reviewed, incorporated into the LWG's dataset as appropriate, and a 5th percentile tissue residue LOEC should be calculated.

Figure 1. Whole body fish tissue LOECs for total PCBs.



6. **Dose-based dietary TRVs for fish.** In EPA's July 6 direction memo to LWG, we had mentioned the possibility of using alternative approaches for derivation of dose-based aquatic dietary TRVs (rather than concentration-based). We looked further into the Menzie-Cura approach, and determined that one of the primary differences in this approach from what LWG has already done in the PRE was that Menzie-Cura seem to recommend using water exposures in the dose calculations, whereas LWG only selected purely dietary sources of contaminant. We if the team agrees that this alternative approach is worth evaluating (the July 6 memo suggested this would be for baseline ERA , not Round 2 report, we first have to decide whether water exposure is an acceptable or important "dietary" pathway. Depending on the chemical, some toxicologists would not say the water pathway would be significant enough to consider in this respect.

7. **Wildlife Egg TRVs:** The egg-based TRV used by LWG and discussed in the 6 July direction memo for 2,3,7,8-TCDD is based on chicken studies, and the general consensus is that this TRV may be overly conservative for birds at the site. Jeremy Buck, for example, noted that more appropriate TRVs could be identified for eagles and ospreys based on field data. Jeremy provided Parametrix with an Elliott and Harris (2001/2002) paper that reviewed effects of TCDD and other chlorinated hydrocarbons on bald eagles. In this paper, based on field data for a site with TCDD, TCDF, and PCB contamination, a TEQ NOAEL of 303 ng/kg wet wt. was determined for embryotoxicity of bald eagles. This is approximately 40 times greater than the chicken-based NOAEL of 7.42 ng/kg currently used in the PRE. The Elliott and Harris (2001/2002) paper also summarized another study suggesting that ospreys are similar in sensitivity to bald eagles (or at least not nearly as sensitive as chickens). Accordingly, the 2,3,7,8-TCDD TRV for raptor eggs may want to be reconsidered since the current value appears to be unrealistically conservative.

   Conclusion: We need to discuss this with Jeremy to determine whether the TRV should be increased to the 303 ng/kg value from this paper, and whether this should be done for the Round 2 report, or the Baseline. Also, would this TRV also apply to all bird receptors, or just bald eagles and ospreys?

8. **Wildlife Dietary TRVs:** Some concerns have been raised that dietary TRVs for wildlife may not properly reflect all available data for wildlife (vs. laboratory) species, particularly for metals. In our previous memos to EPA in preparation for their July 6 memo to LWG, Parametrix was asked to focus first on the organic chemicals of primary concern (e.g., dioxins, PCBs, PAHs, etc.) rather than metals. However, at the suggestion of Jennifer Peterson, we next evaluated wildlife TRVs for metals relative to the toxicity values identified by EPA in development of the ecological soil screening values (Eco-SSLs). To date, the Eco-SSL documents provide thorough, peer-reviewed, literature TRV derivations for the following metals of interest at Portland Harbor: arsenic, cadmium, chromium, and lead. The avian and mammalian NOAEL-based TRVs used by EPA to develop Eco-SSLs are compared below to the NOAEL and LOAEL TRVs used in the PRE in Table 1. In general, the LWG's NOAEL TRVs are similar to the Eco-SSL TRVs, although the mammalian NOAEL's from the Eco-SSL documents were at least 2x-lower than NOAEL's derived by LWG. The most significant difference between the Eco-SSL values and LWG's NOAEL was the mammalian TRV for chromium.

   It is important to note, however, that there were some methodological differences in how LWG vs. EPA selected appropriate studies for TRV derivation. The LWG prioritized studies in which the exposure route was the diet over studies in which gavage or drinking water was the exposure route. Therefore, only NOAEL values were available from dietary studies as identified by the LWG, while the Eco-SSL TRV selection process considered studies using additional exposure pathways (food, gavage, and drinking water exposures). While these other pathways were not considered by EPA to be as scientifically relevant as purely dietary studies, if other test attributes were weighted sufficiently high (EPA used a formal study weighting scheme), the study was still selected for TRV derivation even if these other pathways were used. Ultimately, however, the Eco-SSL mammalian TRV for chromium is still largely based on a dietary study with chromium (VI) (see Table 6.2 in USEPA [2005]). Accordingly, the LWG should consider evaluating the EPA Eco-SSLs to ensure they have identified all relevant studies.

Conclusion: So long as the government team is comfortable with the differences in how EPA derived their TRVs from the Eco-SSL documents, these TRVs should probably be used instead of the PRE TRVs.

Table 1. Comparison of wildlife TRVs to EPA's Eco-SSL wildlife TRVs. NOAELs that are more conservative than those derived by LWG are highlighted in bold text.

	Bird TRVs (mg/kg/d)			Mammal TRVs (mg/kg/d)		
	LWG		Eco-SSL	LWG		Eco-SSL
Metal	NOAEL	LOAEL	NOAEL	NOAEL	LOAEL	NOAEL
Arsenic	2.3	6.8	2.24	2.6	5.4	**1.04**
Cadmium	7.3	29	**1.47**	3.5	13	**0.77**
Chromium	1.0	5.0	2.66	1,466	NA	**5.66**
Lead	2.0	20	1.63	11	90	**4.7**

References

Dyer, S.D., C.E. White-Hull, and B.K. Shephard. 2000. Assessments of chemical mixtures via toxicity reference values overpredict hazard to Ohio fish communities. Environ. Sci. Technol. 34:2518-2524.

Elliott, J.E. and M.L. Harris. 2001/2002. An ecotoxicological assessment of chlorinated hydrocarbon effects on bald eagle populations. Rev. Toxicol. 4:1-60.

Rombough, P.J. and E.T. Garside. 1982. Cadmium toxicity and accumulation in eggs and alevins of Atlantic salmon *Salmo salar*. Can. J. Zool. 60:2006-2014.